final operation was broadcasting by radiophone at various times and wave lengths, all prearranged. * * * For our radiophone receiver we carried a standard Westinghouse "RC" set with special light-weight batteries. * * *. We were now about a mile above Lake Michigan (evening, May 31) and could dimly see the outlines of the approaching Michigan shore. * * *. I first picked up a soprano solo—very pretty but hardly what we needed to win a balloon race. I was just putting down the receiver when the words of the announcer came clear and distinct—something about the balloon race. I gave one receiver to Andrus and we both listened in. "Four balloons in the National Race from Milwaukee are reported nearing Chicago." * * * After passing the shore line I checked our location and route, while Andrus tuned in for our weather report now about due. He quoted the words aloud as they came. (Here follows a complete synopsis of the weather map and wind forecast for the Lake region based on the 7 p. m. map of May 31).

The first weather information that we hoped to pick up was the regular daily report sent out by the Detroit News at 10.30 a. m. (June 1). Just previous to that time I conscientiously listened to several jazz pieces played on the phonograph, then, finally, came the announcement: "We will now conclude our program this morning with the reading of the daily weather report." Here I passed the receiver to Andrus, who tried to get a better adjustment, but lost connection and was not able to pick it up again. Later, at the scheduled time for our special report we also tuned up, but were unable to catch a thing. We later found the trouble to have been with the Western Union, who failed to deliver our message for about three hours after it was sent to Chicago, but we did not know then but that it was our own fault and gave up the message as lost. * * * . We had organized a successful system of getting weather reports in the air and had demonstrated to our entire satisfaction that it was not only a great help in operating a balloon but also a step forward toward greater safety.

We had been more than 15 hours over water, but felt perfectly safe throughout the whole time simply because we were still in touch with the world by radio. Our failure to get one of the messages brought home to us its importance more strongly than anything else could have done.

But the best thing I leave for the end. Major Westover, the winner of the race, also carried radio, which I procured for him before the race and which he used on the same schedule. Hence, the big idea in its first trial was not only proved sound but was a real winner as well.

From a brief résumé of the broader aspects of the meteorological conditions from May 29 to June 2, the impression is given that the dominating factors, insofar as they affected the Lake region and adjacent territory, were a succession of great drifts, first an extensive one from the southwest, and then in succession one of lesser magnitude from the west. The drift from the southwest apparently had its inception as early as May 26 or 27, in the form of a weak current from the South Atlantic, drifting inland toward the northwest, that progressively deepened, strengthened, and veered until it had attained the proportions of the extensive SW.–NE. drift observed on May 30 and 31. This drift temporarily blocked the passage of HIGHS along the northern frontier to the Lakes from the west, but gave way in its lower levels before the advance of the eastern segment of the Alberta HIGH on the afternoon of May 31.

The protrusion of the eastern segment of the Alberta HIGH into the Lake region, and the attendant formation of a definite low center over the Lakes may be construed as due to the overlapping at this point of a current from the west that was originally of Polar or northern origin, eventuating the final cycle in the development of the LOW that had its genesis in the southern portion of the deep SW.–NE. drift. Attention is brought to the striking resemblance of this construction to the life cycle of a LOW as depicted by Bjerknes and Solberg (page 80, V. Bjerknes, Dynamics of the Circular Vortex, Christiania, 1921); likewise to the other points of similarity between the assembled mental picture described in these concluding paragraphs, and the general theory of the Polar Front advanced by these Norwegian investigators.

The assumed Polar current, just referred to, had apparently backed in direction from an originally NW. to SE. tongue of cooler air, and was now (June 1–2) evidenced by aerological observations as a drift aloft from the west, that bent toward the northeast where it merged with the SW.–NE. drift over the Atlantic States. This drift from the west, or remnant of the assumed Polar current, was dying out, with which fact may be connoted the flattening out of the HIGH over the Central States, and the eventual becalming of all the pilots who were still in the air by the evening of June 1, 1922.

BUMPY FLYING CONDITIONS ALONG THE ATLANTIC COAST.[1]

By A. W. PARKES.

The writer was a radio observer on naval seaplanes and flew the Atlantic coast from Cape Cod to New Orleans and over many of the West Indian islands.

As a general rule, under similar geographical conditions, the hotter the climate the greater the bumpiness in the air. The worst places experienced were the Hudson River at a low altitude (200 feet or lower), the Florida Keys, and the bay at Guantanamo, Cuba.

The probable explanation of the bumps in the Hudson is that the west wind passing over the Palisades tends to form an eddy on a horizontal axis, going down over the Hudson, flowing westward near the water, and rising near the sides of the Palisades as is roughly shown in the accompanying diagram.

A seaplane going up the river often experiences a drop of 15 to 50 feet very abruptly, and sometimes only one wing goes down or just the nose or just the tail. Under these conditions with a large plane both pilots have all they can do to manage the controls.

The case over the Florida Keys is quite different, though the effect is the same or worse. On nearly every day there seem to be strong convectional currents rising over these small islands, which are heated to a much greater heat by day than the water, thus causing that less dense air to rise and, consequently, the colder to descend to fill its place. "Bumps" are the consequences.

I have heard pilots say "I'll bet I could tell when we were over Guantanamo Bay if I were blindfolded or if it were pitch dark, it's so bumpy in that vicinity." Guantanamo Bay lies on the southern part of Cuba, and there are mountains about two-thirds of the way around it. During the months of February and March, while the writer was there, the weather rotated daily like clockwork—a very calm morning, followed by a breeze at 2 p. m., becoming strong at about 4 to 5 p. m. every evening, with almost no exception, during those two months. But even though there was little surface wind in the morning, this excessive bumpiness occurred throughout the day, although it was worse in the afternoon. This necessitated as much flying as possible to be done in the early morning. The reason for the bumpiness seems to be a combination of the two reasons given previously, i. e., the heated land and the deflections due to the mountains. A thing of interest is the fact that when flying directly over the funnel of a battleship the effect can be felt for at least 200 feet up.

It may also be interesting to note that we could feel the concussion on our plane from a broadside of a battleship when we were 4,000 feet above the ship.

[1] Submitted in reply to the request in the MO. WEATHER REV., Aug., 1919, p. 532, for notes on flying and the weather.

Without any doubt, fog and rain are the two greatest enemies of the aviator. The worse of these is the fog, however. Rain to a pilot feels exactly as one's foot feels when "gone to sleep" except that it is about 10 times as bad. It feels as though someone had a mass of needles pressing them onto the hands and face, to say nothing of the extreme coldness of the result. Fog, or cloud, however, is very different. The order was given for a squadron of seaplanes to leave Hampton Roads, Va., to come north to greet the *George Washington* when she came back with President Wilson from France. On leaving Cape May, N. J., there was a cloud extending down to about 250 or 300 feet altitude, so the order was given to ascend above the clouds where flying was very simple by compass. Being seaplanes, there was a great fear that something would go wrong and that the squadron would be over land rather than water if forced to land suddenly, which would necessarily cause a total wreck. The commanding officer of the flagplane sent us all a radio message, "Remain aloft, am going down to ascertain weather conditions." We all received the message and ok'd it, then waited for the result. The flagplane dove into the clouds—out of sight—and in about 15 minutes another message came, "All clear 200 feet, descend." Immediately all the remaining planes dove into the clouds. We did not see the other planes until we had arrived at Rockaway Beach hours later. We were at that time in the vicinity of Atlantic City. We managed to fly along the surface of the water, barely able to see 100 yards ahead, contrary to the commanding officer's report, and having the constant fear of an approaching ship whose mast we might hit. We finally spied Fire Island Light, stopped, asked directions, and took off again. Soon the fog came in still worse, and many a time the wings would be at an angle of 45 to 60 degrees to the horizontal, which is great for a large, 5-ton seaplane. Both port and starboard pilots together worked as fast as they could, to keep her righted, the level-bulb being of no use because it did not show a horizontal owing to the turning of the seaplane. The climax came near Long Beach, where, coming out of the fog over water, we barely missed a house, rose, and turned, only to skim the top of a huge elm tree. Directly ahead was a little creek, into which our pilot headed the machine. It was just big enough to clear the banks. We put out our anchor immediately and waited for the fog to clear. At 11 o'clock it had lifted, but it was raining instead. As rain was merely disagreeable and fairly bad for the propellers, we made our way in the rain to Rockaway Beach. After landing, anchoring, covering up the motors, etc., our commanding officer came down and gave us the order to go out and meet the *George Washington*. All wet and cold, we "took-off" again and met the ship, the rain driving in our faces all the while.

These are but a few incidents which could be paralleled by many an aviator, especially by one who has flown in the South or over land and water.

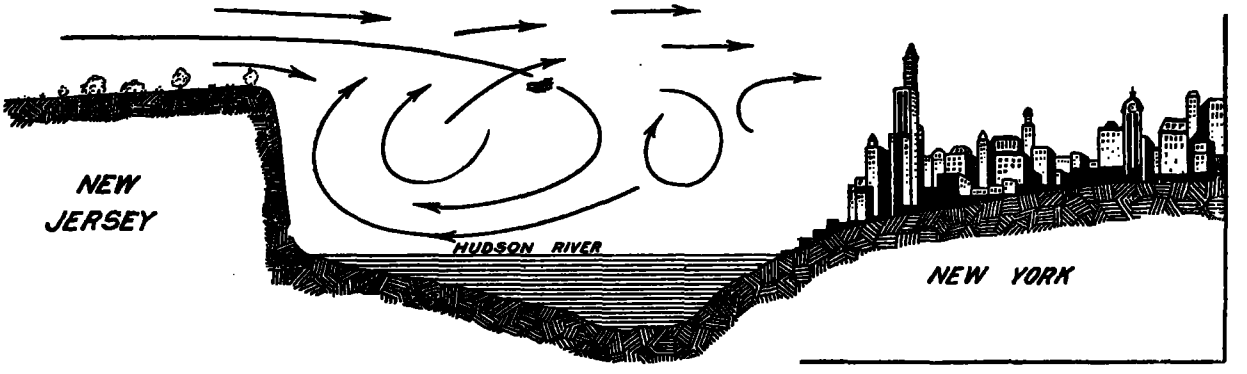

FIG. 1.—Showing the formation of a horizontal eddy over the Hudson River near New York City.

THE AUSTIN TORNADO OF MAY 4, 1922.

By FRED MORRIS, Cooperative Observer.

[University of Texas, Austin, Tex., June 14, 1922.]

EASTERN CLOUD.

The morning of May 4 was sultry, with clear skies and a very light southeast breeze. By 11 o'clock small cumulus clouds had begun to form. These clouds remained stationary, or practically so; if they had any movement it was so slight that their direction could not be noted.

By noon the cumulus clouds to the northeast had begun to develop into a cumulo-nimbus. There was nothing unusual in the appearance of the cloud at this time. It was just a "thunderhead" from which a shower might be expected later in the afternoon. It remained practically stationary, slowly increasing in size until about 2:30 p. m., when it began to spread southward.

At about 3:15 p. m., what appeared to be cumulus clouds at a very high altitude and moving rapidly were observed coming in from the southwest. Below these and coming in from a point somewhat east of south could be seen ragged patches of dark cloud. The scud floating rather low and at a high velocity was coming in from all directions south of a line drawn east and west through the university. These clouds formed rapidly into a huge ugly looking mass with a very low, densely black base and high pink summit. This new cloud was building up at a point somewhat east of the original cloud and about half way between it and town. The development of this second cloud was very rapid; also, it seemed to be moving southward as it developed. At about 3:45 p. m. the first sharp peal of thunder was heard. Up to this time the sky below the bases of these clouds had remained practically clear, but now began to show dark streaks, indicating that precipitation had begun.

By 3:50 p. m. a definite movement southward of both clouds was in progress. The eastern portion of the original cloud had become obscured by the second cloud